REMARKS/ARGUMENTS

Claims 1-6, 8-13 and 15-26 are active. Claims 15, 19, 25 and 26(constructively) are withdrawn.

The claimed invention provides a photovoltaic device containing carbon nanotubes having a band gap in the range from 0.5 to about 1 eV. As a result of having this very specific range of band gap, the claimed invention is significantly more efficient in the conversion of light energy to electrical energy than conventional photovoltaic devices. Specifically, the device according to the present invention is capable to convert light of longer wavelength than conventional devices, while being constructed of lower cost organic materials than conventional devices.

Applicants wish to thank Examiner Ho for the useful and courteous discussion of this application with Applicants' U.S. representative on January 13, 2010. At that time, Applicants' U.S. representative discussed the band gap energy value range of carbon nanotubes and argued that carbon nanotubes, specifically the SWNT's are tunable having band gap values which are inversely proportional to the diameter of the nanotubes. Applicants' U.S. representative provided three literature articles showing that carbon nanotubes band gaps are tuneable based on diameter and that band gaps well outside the range of 0.5 to 1 eV described by the Vinciguerra reference are conventionally known. Therefore, Applicants' U.S. representative argued that a band gap in the range 0.5 to 1 eV is not an inherent property of a carbon nanotubes. The following reiterates and expands upon that discussion.

The rejection of Claims 1-4, 6, 8-10, 13, 16-18 and 21-24 under 35 U.S.C. 102(b) or in the alternative under 35 U.S.C. 103(a) over Kymakis et al. (Applied Physics Letters,

American Institute of Physics. New York, Us vol. 80, no. 1,7, pages 112-114) with support of Vinciguerra et al. (U.S. 7,329,902) is respectfully traversed.

Kymakis describes a photovoltaic device containing poly(3-octylthiophene) and single walled carbon nanotubes. Kymakis is silent with respect to describing a band gap energy for the single-walled carbon nanotubes utilized in the described photovoltaic device. Nowhere does this reference disclose or suggest carbon nanotubes having a band gap from about 0.5 to about 1 eV.

The Office has cited Vinciguerra to show "inherency" of a band gap range of 0.5 to 1 eV in SWNT's (Official Action dated October 17, 2009, page 9, lines 4-12).

Vinciguerra describes a light emitting device wherein carbon nanotubes serve as a conduit for hole and electron recombination and emit light in the IR region (Col. 4, lines 25-30). The Office has pointed to the description in Col. 4, lines 3-7 of this reference to show SWNT band gap range of 0.5-1.0 eV (Official Action dated October17, 2009, page 9, lines 8-9).

However, Applicants submit that upon careful consideration of the Vinciguerra description, one recognizes that the discussion is simply describing a specific species set of carbon nanotubes which luminesce, i.e. emit light. As Vinciguerra describes SWNT's which are useful to prepare IR lasers, one must reason that carbon nanotubes having band gaps different from those indicated as luminescent must be known.

Applicants submit in the IDS submitted with this paper, 3 reference articles directed to description of carbon nanotubes:

1) Electronic Band Structure of Carbon Nanotubes; Kunal Ghosh (November 25, 2005, Stanford University.

2) Carbon Nanotubes – the Route Toward Applications; Ray H. Baughman, et al., Science 297, 787 (2002).

3) Structural Dependence of Exotic Optical Transitions and Band-Gap Energies in Carbon Nanotubes; Dukovic et al., Nano Letters, Vol. 5, No. 11, 2005 (2314-2318)

Applicants note the description in Ghosh (page 2, lines 19-21) that the bandgap of semiconducting nanotubes can be tuned by adjustment of the nanotubes diameter. Similarly, Baughman (page 787, Col. 1, last lines of second paragraph) describes that the band gap of semiconductors is inversely proportional to nanotubes diameter. Finally, Dukovic shows in Figure 3(b) measured band gaps ranginging from 1.08 (estimated) to greater than 1.6 for nanotubes diameters in a range of approximately 1.25 to 0.8 nm.

Applicants submit that the references clearly show that carbon nanotubes exhibit a wide range of band gap values, much broader than the narrow range described by Vinciguerra. Accordingly, Applicants respectfully submit that Vinciguerra does not provide a universal fact as alleged by the Office and therefore a band gap range of 0.5 to about 1 eV as according to the claimed invention cannot be inherent to the description of Kymakis.

Applicants further note that the Office previously cited Ago et al. (Official Action dated October 20, 2008, page 4, lines 7-16) and as an indication of the art, this reference (page 1285, footnote [13]) describes a band-gap range for photovoltaic devices of 3-14 meV. This range is nearly 100-fold smaller in terms of wavelength requirement (higher energy radiation) than the band-gap of the present invention.

Applicants respectfully point to the following case law as cited in MPEP § 2112 IV.:

> To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. *In re Robertson*, 169 F. 3d 743,745, 49 USPQ2d 1949, 1950-51 (Fed. Cir.1999)

For all the above reasons, Applicants respectfully submit that the cited reference as supported by Vinciguerra cannot anticipate the claimed invention. Accordingly, withdrawal

of the rejection of Claims 1-4, 6, 8-10, 13, 16-18 and 21-24 under 35 U.S.C. 102(b) over Kymakis with support of Vinciguerra is respectfully requested.

The rejection of Claims 1-4, 6, 8-10, 13, 16-18 and 21-24, in the alternative under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra is respectfully traversed.

Applicants respectfully note the following excerpt from the Office's own discussion of **"Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in View of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.*"**

> "The rationale to support a conclusion that the claim would have been obvious is that **all the claimed elements were known in the prior art** and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art at the time of the invention ""[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." **If any of these findings cannot be made, then this rationale cannot be used to support a conclusion that the claim would have been obvious to one of ordinary skill in the art,"** (Federal Register, Vol. 72, No. 195, page 57529) (Bold added) (citations omitted)

In view of the above discussion of Kymakis as supported by Vinciguerra, Applicants submit that Kymakis does not make all the claimed elements known and therefore, a conclusion of obviousness cannot be supported. Accordingly, Applicants respectfully request that the rejection of Claims 1-4, 6, 8-10, 13, 16-18 and 21-24, in the alternative under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra be withdrawn.

The rejection of Claim 5 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Tsukamoto et al. (JP 2003-096313) is respectfully traversed.

Claim 5 directly depends from Claim 1 and includes all the description of the independent claim. The deficiencies of the primary references relative to anticipating and/or rendering obvious the invention described in Claim 1 and claims dependent thereon is

described above. Tsukamoto neither discloses nor suggests a device according to the claimed invention wherein a band gap of said carbon nanotubes lies in the range of from about 0.5 to about 1 eV and therefore does not cure the deficiencies of the primary references.

Tsukamoto describes a Field Effect Transitor wherein a composite of carbon nanotubes and organic polymer is used as a semiconductor. This reference is silent with respect to a band gap for the carbon nanotubes and as shown by the Ago reference cited above, carbon nanotubes are generally known to have band gaps of 3-14 meV. Therefore, a band gap of 0.5 to about 1 eV cannot be inherent to the description of this reference and, as indicated, the cited combination of references cannot render the claimed invention obvious. Accordingly, withdrawal of the rejection of Claim 5 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Tsukamoto is respectfully requested.

The rejection of Claims 11 and 12 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Forrest et al. (U.S. 6,451,415) is respectfully traversed.

The deficiencies of each of the cited primary reference combination has been described above. Forrest describes photodetector organic photosensitive optoelectronic devices having multilayer structures and an exciton blocking layer. This reference is cited to show a multilayer structure. However, Forrest does not disclose or suggest multilayers containing carbon nanotubes having a band gap in the range of from about 0.5 to about 1 eV and therefore Forrest does not cure the basic deficiencies of the primary reference combination. Withdrawal of the rejection of Claims 11 and 12 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Forrest is respectfully requested.

The rejection of Claim 20 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Ganzorig et al. (Alkali metal acetates as effective electron injection layers for organic electroluminescent device," Materials Science and Engineering B,

Elsevier Sequoia, Lausanne, Ch, vol. 85 no. 2-3, 22 August 2001 (2001-08-22), pages 140-143) is respectfully traversed.

Ganzorig is cited to show a coating layer of alkali metal acetate of fluoride on an electrode. This reference describes a coating applied at the interface of an aluminum/tris(8-hydroxyquinoline)aluminum electrode/transfer layer. Nowhere does Ganzorig disclose or suggest a composite of carbon nanotubes and of at least one organic hole conductor, wherein the band gap of the carbon nanotubes lies in the range of from about 0.5 to about 1 eV.

In view of the above, Applicants respectfully submit that Ganzorig does not cure the basic deficiency of Kymakis with support of Vinciguerra previously described, and therefore, the cited combination of references cannot render the claimed invention obvious. Accordingly, withdrawal of the rejection of Claim 20 under 35 U.S.C. 103(a) over Kymakis with support of Vinciguerra and further in view of Ganzorig is respectfully requested.

Applicants respectfully submit that the above-identified application is now in condition for allowance and early notice of such action is earnestly solicited.

Respectfully submitted,

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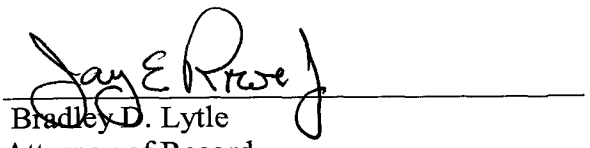

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